Stephanie van Ryzin

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| **Building a Water Filter System** | | |
| **Teacher: Stephanie van Ryzin** | | **SUBJECT: Urban Farming (Self-Contained)** |
| **SCHOOL: Thomas Edison CTE High School** | | **GRADE: 10-12th** |
| **UNIT** | Water | |
| **ESSENTIAL QUESTION** | How do filtration systems help to solve world problems? | |
| **LINK(S) TO PRIOR KNOWLEDGE** | Students will have already learned about the water cycle and the scarcity of fresh water on Earth. | |
| **BACKGROUND INFORMATION** | There are many different methods of filtration, each with the goal of separating substances. Filtration systems are important to providing safe drinking water. The simplest way to “filter” is to pass a mixture, or solution, of a solid and a fluid through a porous material so that the so that the solids are trapped as the fluid passes through. Providing a safe and sustainable supply of drinking water has been a challenge for millennia and is the most pressing environmental problem in much of the developing world. New pathogens, chemicals containments, changing climates, population growth all lead to pressures that will require innovative scientific and policy responses. | |
| **CCLS: Common Core Learning Standards** | **[CCSS.ELA-Literacy.RST.11-12.3](http://www.corestandards.org/ELA-Literacy/RST/11-12/3/)**   * Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.   **[CCSS.ELA-Literacy.W.9-10.2](http://www.corestandards.org/ELA-Literacy/W/9-10/2/)**   * Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. | |
| **SUBJECT AREA STANDARDS**  **Next Generation Science Standards** | [**ESS2.C: The Roles of Water in Earth’s Surface Processes**](http://www.nap.edu/openbook.php?record_id=13165&page=184)   * [The abundance of liquid water on Earth’s surface and its unique combination of physical and chemical properties are central to the planet’s dynamics. These properties include water’s exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.](http://www.nap.edu/openbook.php?record_id=13165&page=184)   [**ESS3.C: Human Impacts on Earth Systems**](http://www.nap.edu/openbook.php?record_id=13165&page=194)   * [The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.](http://www.nap.edu/openbook.php?record_id=13165&page=194) | |
| **INSTRUCTIONAL GOALS** | * Students will be able to describe how different materials act as filters. * Students will be able to design and construct a water filter system. * Students will be able to explain how their water filter works | |
| **TECHNOLOGY** | Students will spend a day researching on computers the properties of different materials. A PPT presentation will be used to introduce the project and discuss key concepts. | |

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| **Day 1: Research & Design** | |
| **AIM** | How do different materials act as filters? |
| **DO NOW**  **3-5min** | Students will write their answers to the following question in their notebook: *Do you filter your water at home? Why or why not?*  Teacher will take a survey of the room and ask students to hold up their hands if they filter their water at home. Teacher will then call on students to share out ideas of why we might want to filter water. |
| **MINI LESSON**  **10min** | **Turn & Talk (2min):** Teacher will ask students to brainstorm the definition of the word “filter” in their groups.  Teacher will call on students to share out and guide students to the definition: *to separate out unwanted solids from a liquid*. Students will copy the definition in their notebooks.  **Turn & Talk (3min):** Teacher will then ask students to brainstorm what types of materials might act as good filters.  Teacher will call on each group and create a class list on the board.  **Project Introduction (5min):** Teacher will handout the project description “Building a Water Filter” and call on students to read as a class. Teacher will explain how each group will be creating a water filter and at the end there will be a contest to see which group created the best filter. Teacher will outline the agenda for Day 1: Research. Teacher will star materials that are good examples of filters and suggest students research these materials today in their groups. Teacher will address any questions students have before moving on. |
| **GROUP ACTIVITY**  **20-25min** | **Group Research & Design:** Students will either go to the computer lab or use classroom computers to research five different materials that they will use as filters for their water system. Students will fill in a graphic organizer with information about each material.  Once students have finished their research, each group will create a drawing of their water filter system and agree on the order of the materials in their filter. Students will include in their design a brief description of how each materials helps to filter the water.  Teacher will circulate and help students as needed. |
| **SUMMARY**  **5min** | **Wrap Up:** Teacher will call the class together and have each group present to the class a short summary (1min) of their strategy for building their water system. |

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| **Day 2: Construction & Contest** | |
| **AIM** | How can we create a successful water filter system? |
| **DO NOW**  **5min** | Students will sit in their groups and take out their graphic organizers from the previous lesson. Students will create a shopping list of the materials that they will need to build their water filter system. |
| **GROUP ACTIVITY**  **15min** | **Building a Water Filter System:** Teacher will instruct students to elect one group member to come to the resource table and gather the required materials for their water filter. Students will work in groups to build their water filter system based on their design from the previous day.  Teacher will circulate and help students as needed. Students will label their water filter with their group’s name. |
| **WHOLE CLASS ACTIVITY**  **15min** | **Water Filter Contest:** Once students have finished constructing their water filters, the teacher will call the class back together. The teacher will have each group bring their water filter to the front of the class and line them up next to each other so that all students can see.  Teacher will have a prepared solution of dirty water (soil/compost mixed with water) and pour the same amount into each groups filter. Students will watch and make observations about what they see.  The teacher will ask students to rank the water filter systems and the class will decide which filter system worked the best. Teacher will ask students why they think this filter was the most successful. Students will discuss as a class what made some of the water filters more successful than others. |
| **SUMMARY**  **10min** | **Reflection:** Students will reflect independently by writing a 7-10 sentence paragraph to answer the following questions.   1. What was successful about your water filter? 2. If you could design a new water filter system knowing what you know now, what would you do differently? Explain. |
| **ASSESSMENT OF THE LESSON** | **Project Rubric:** Teacher will use a rubric to grade students on the different components of the lesson. (see below) |
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| **DIFFERENTIAION:** Students will be grouped heterogeneously in mixed ability. Students will use a graphic organizer and guided checklist to make sure they complete each part of the project. Hands-on activity for kinesthetic learners. Students will have the option of completing their reflection for homework if they need extra time. | |

**Project Rubric**

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|  | **4- Excellent** | **3- Good** | **2- Acceptable** | **1- Poor** |
| **Research** | Describes 5 different materials and provides details from research to their use as filters. | Describes 4-5 different materials and provides details from research for their use as filters. | Describes 3 different materials and/or doesn’t provide details for their use as filters. | Describes only 1-2 different materials and doesn’t use details from research. |
| **Design** | Design includes each material and what layer it will be located in the water filter with a description of how all materials will help to filter the water. | Design includes each material and what layer it will be located in the water filter with a description of how most materials will help to filter the water. | Design includes some layers in the water filter with a description of how some materials will help to filter the water. | Design does not include many layers and does not describe how materials will help to filter the water. |
| **Reflection** | Reflection is the appropriate length and provides many specific details as to next steps that could be taken. | Reflection is the appropriate length and provides some details as to next steps that could be taken. | Reflection is not appropriate length and only provides some explanation. | Reflection is not appropriate length and does not provide explanation. |
| **Participation** | Present every day of the project and remained on task the entire time. | Present every day of the project and remained on task most of the time. | One absence and or was not always on task. | Was not present for 1-2 days or was not on task each day. |

**Student Grade = \_\_\_\_\_/ 16**